OBSERVATIONS UPON APPENDICITIS.

By GEORGE RYERSON FOWLER, M.D.,

OF BROOKLYN,

SURGEON TO ST. MARY'S HOSPITAL AND TO THE METHODIST EPISCOPAL HOSPITAL.

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THE PROGNOSIS OF APPENDICITIS.

THE prognosis of appendicitis is unfavorable in the cases treated non-operatively in proportion to the severity of the infection; and in the cases treated surgically in proportion to the delay in instituting operative interference.

While there are doubtless many cases of endo-appendicitis of a mild character which recover, it is equally true that a very large number of the cases which are lost, both with and without operation, were mild cases in the beginning of the attack. The disease may pursue an exceptionally rapid and uninterrupted course to a fatal termination in thirty-six hours from the beginning of the attack, as is exemplified by the following case:

O. P., aged fifty-eight, was admitted to St. Mary's Hospital at 9 P.M. on April 27, 1892. He was found by the ambulance surgeon sitting in a saloon suffering from acute abdominal pain. He had first felt the pain while straining at stool just before starting for work that morning. A diagnosis of appendicitis was made, and he was removed to the hospital for operation. He was given a hypodermatic injection of morphine on the way to the hospital. This caused so much relief that he afterward refused operation, although it was repeatedly urged upon him during the next twenty hours. The temperature, which upon admission was 102° F., fell, after the full effect of the opiate was obtained, to 99° F., and there remained. He was seized with severe pain at 6.30 P.M. of the day following, and died in collapse

within half an hour, just thirty-six hours after the first evidence of the disease. The pulse just before this was 120.

The autopsy, conducted by Dr. Clayland, the assistant pathologist of the hospital, revealed a perforated appendix and a rupture of a large, encysted, sero-purulent collection into the general peritoneal cavity.

If this case be taken as a type, and the period of time from the administration of opium to the final catastrophe be lengthened from the second to the fifth day, a large number of the cases formerly treated would be included in its class.

In the heretofore indifferent position of the profession towards this disease, the cases which were more or less acute in the commencement, but which became subacute in a few hours, were next gravest in character. These are cases in which the opium treatment is not necessarily to blame for allaying the anxiety that would naturally be felt by the practitioner when the gravity of the conditions present was fully recognized. They are rather cases in which necrotic changes in the mucous membrane follow a simple endo-appendicitis. Infection of the sub-mucosa takes place, and a renewal of the symptoms depends upon the supervention of a parietal appendicitis, either serous or suppurative. Involvement of the peritoneum (the peritoneal stage of Talamon), or the occurrence of a septic thrombosis and gangrene of the organ follows. The following case is a good example of such a condition of affairs:

J. L., a Swede, was admitted to St. Mary's Hospital with a history of having been suddenly attacked with severe abdominal pain, while lifting a heavy cake of ice, forty-eight hours previously. He had taken a cathartic for the relief of the pain; no other medicine had been administered, Dr. F. E. Wilson was finally summoned, and found the patient sitting up. He complained of pain in the right iliac region. The pain was not severe, nor did the pulse (96) and temperature (100° F.) indicate a severe grade of the disease. He was ordered to go to bed until the arrival of the ambulance. This injunction he did not obey, and the ambulance surgeon found him sitting in a chair. His friends said he had been up and down stairs several times during the day.

He was made ready for operation immediately after his arrival at the hospital. The usual right lateral incision revealed sero-purulent fluid free in the peritoneal cavity; very scanty adhesions were present. Septic peritonitis was already under way; an appendix perforated at about three-fourths of an inch from the tip, and gangrenous for about one-fifth of its length, was removed. All this had occurred within sixty hours from the beginning of the attack. The patient died from the septic peritonitis which was present at the time of the operation.

The striking feature about this case was either the absence of symptoms proportionate to the gravity of the conditions present, or the indifference of the patient to the pain that one would naturally expect to be present in such a case. This form of the disease is calculated to cause the physician to hesitate in the diagnosis, and much valuable time is therefore lost.

Talamon has asserted that this subacute form of the disease corresponds most frequently with the class of cases in which the inflammation occurs in an appendix not covered posteriorly with peritoneum, and in which, therefore, perforation may occur into the retro-cæcal connective tissue outside the peritoneum. The unfavorable prognosis in this class of cases is due, in his opinion, to the extra-peritoneal suppuration, which, without any obstacle to its advance, infiltrates the neighboring muscles and tissues, and provokes formidable and fatal complications. While I am willing to admit the dangerous character of this, as well as of any other form of the disease, in my experience the cases which become subacute after having been acute, as well as the cases which have been subacute from the commencement, and in addition those in which "cures" are attempted by the use of opium, are all equally and exceedingly dangerous. As an example of the latter class the following case, in which some particularly sad features were present, may be cited:

W. R., a medical student, was suddenly attacked with pain in the abdomen, referred to the right iliac region. A chill accompanied the attack, and vomiting followed it. The temperature was 101° F., and the pulse 98. The young man himself made the diagnosis of

appendicitis, and a neighboring practitioner was summoned by the family. This practitioner succeeded in shaking the young student's confidence in his own diagnosis, and the patient was given as treatment three grains of morphine and ten grains of calomel daily. He seemed to improve, but on the sixth day another attack occurred. From this he again improved under a continuation of the same treatment. On the eighth day another advent of acute pain was followed by collapse. He was seen by Dr. R. W. Sharp, who confirmed the young man's original diagnosis, and afterwards by Dr. Delatour. He was carefully removed to the Methodist Episcopal Hospital for operation, but his condition never improved sufficiently to warrant it.

In my judgment, the only cases treated non-operatively in which the prognosis can be said to be favorable are those in which the disease is neither progressive nor stationary, but, on the contrary, is retrogressive within the first twenty-four hours after the attack, as evinced by the symptom of tenderness—providing this latter has not been masked by the administration of opium or some of its derivatives. If, on the one hand, these indications are fulfilled, the attendant may encourage the patient that he will recover without operation; but, on the other hand, both will lean upon a broken reed, if reliance is placed upon any or all of the other symptoms. To sum up the whole matter, therefore, the prognosis, in cases in which no operative interference is instituted, is always uncertain; particularly so in cases in which the first symptoms subside and recur, as well as in cases which are subacute from their commencement.

The mode of termination may be: (1) By perforation, prior to the formation of proper adhesions, and thus giving rise to septic peritonitis; (2) infection of the peritoneum through the lymphatics or other channels of migration for the *bacillus coli communis* and other micro-organisms. In these cases the serous effusion may be (*a*) encysted, and subsequently become purulent; or (*b*) non-encysted, and occupy the general peritoneal cavity. In either case suppurative changes may occur. In the case of the encysted variety, a secondary rupture of this will lead to a rapidly fatal general septic peritonitis. (3) The rupture of an appendicular abscess, and consequent peritonitis. (4) Septic complications, arising from extension to and infection of the post-

peritoneal connective tissue. (5) Gangrenous inflammation of the appendix, of the adhesions which surround it, and of the neighboring parts including the blood-vessels, giving rise in the latter case to fatal hæmorrhage. (6) Pylephlebitis, hepatic abscesses with their sequelæ (purulent pleuritis from extension, pneumonia, etc.). (7) The purulent accumulation may open into the cæcum, rectum or bladder, and the patient perish from septo-pyæmia, due to repeated infection of the original abscess cavity from these sources.

The mode of death may be from shock and collapse, as happens occasionally in cases of sudden primary perforation (perforation of the appendix without pre-existing adhesions). This condition supervenes, however, much more frequently in secondary perforation (rupture of appendical abscess, or encysted sero-purulent deposit). Septic peritonitis will destroy life by the combined effects of its own septic products, and a stercoræmia, resulting from the intestinal paresis which follows in its wake. The effects of these septic products are most pronounced upon the circulatory organs, as evinced by the paralysis of the inhibitory cardiac nerve apparatus. Complications and sequelæ both of the disease and of the operative procedure will bring about a fatal result by methods peculiar to themselves.

The prognosis in cases subjected to operative interference will vary with the stage of the case at which the operation is undertaken, with the conditions found when the abdominal cavity is opened, and with the skill of the operator both in the manipulative technique and in the judicious employment of antiseptic or aseptic measures. There are some unfortunate sequelæ of laparotomies for appendicitis as well as for other conditions requiring the opening of the peritoneal cavity, which will be referred to later on.

All of the conditions heretofore mentioned that bring about a fatal termination may produce death after surgical interference, provided they were present before it. In other words, the operation will fail to rescue those already doomed by the existence of septic peritonitis, or septo-pyæmic general infection.

The prognosis after operation in the chronic relapsing cases

is generally good. In twelve cases operated upon by Bull[1] one proved fatal. In sixty-four cases collected by the same writer, occurring in the practice of other surgeons, not a single death is recorded. Kümmel[2] reports twelve operations, and no deaths.[3] Quénu[4] reports four additional cases operated upon by himself, all of which recovered. To this are to be added eighteen cases in my own hospital service, one of which proved fatal from a co-existing ulcerative enteritis.

The prognosis in cases of this type of the disease not operated upon cannot, in the absence of definite knowledge upon the subject, be definitely stated. Whether or not the appendix ever fully recovers itself after one or more relapses is a question which cannot yet be answered. In any case radical operation is more trustworthy than waiting for nature's uncertain methods, and therefore every patient who suffers from chronic relapsing appendicitis should be encouraged to submit to an appendicectomy.

With regard to the prognosis after the occurrence of one or more of the unfavorable conditions heretofore mentioned, it may be said in a general way, that the element of time will, as a rule, govern the fate of these cases. For instance, a perforation may occur, and yet the surgeon may luckily have succeeded in opening the peritoneal cavity before the escape of any of the contents of the tube. The following case will illustrate this point:

Miss M., aged twenty-two, a patient of Dr. Cruikshank, was placed by him under my care for operation, after a consultation of medical men had advised delay in the case. The usual right lateral incision revealed an appendix free in the abdominal cavity, absolutely without adhesions, swollen to the size of the little finger, and perforated in two places. The latter were minute openings, through which soft fæcal matter oozed as the ligature was tightened about the base of the organ preliminary to its excision. The patient made a good recovery.

[1] Medical Record, New York, March, 1893.

[2] Archiv für klinische Chirurgie, Vol. LIII, Parts 3 and 4.

[3] Seven of Kümmel's cases and one of Quénu's are included in Bull's statistics.

[4] Bull. et Mem. de la Société de Chirurgie de Paris, Vol. XVIII, p. 397.

The prognosis after the supervention of the symptoms of peritonitis will vary according as the surgeon is permitted to interfere while the inflammation of the peritoneum is circumscribed or local on the one hand, or general on the other. With a strictly localized peritonitis, even though this enclose a considerable effusion which has undergone suppuration (encysted intraperitoneal focus of suppuration), the surgeon still has much in his favor, provided no unfortunate error in the technique permits the septic material to contaminate the peritoneal cavity. The same may be said of appendical abscess. General peritonitis, without the occurrence of suppurative changes in its resultant serous affusion, may likewise permit a favorable termination. Even if suppurative changes have occurred in an effusion which is located in the general peritoneal cavity the case is not deemed necessarily hopeless by some surgeons, although the chances of recovery diminish progressively with the lapse of time since the infection of the fluid. The number of cases which recover under these circumstances must be exceedingly small as compared to those that perish. The effused serum forms a culture medium favorable to the development of bacteria, and in a few hours it may be transformed from an innocent serous fluid to a virulent toxic material giving rise to a rapid and general infection, before the occurrence of any suppurative changes whatever.

Undoubtedly, under these circumstances, the operative procedure, while it gives the patient the only chance of recovery, tends to hasten the end in cases that prove fatal. The general vital resistance to infection is always lessened by the administration of an anæsthetic. It is not an infrequent occurrence to have patients develop the most pronounced general septic symptoms in cases where the condition of the peritoneal cavity is such as to cause surprise that the general symptoms were not more pronounced prior to the operation. What would have happened a few hours later is brought about by the anæsthetic and operative procedure. The justifiability of interference in many of these cases is not lessened by this possibility; the necessity for early interference is simply emphasized by it.

With an extravasation of pus, serum, or sero-purulent fluid

in connection with fæcal matter, revealed by the operative procedure, but one result can be expected. It is the rarest occurrence in all surgical practice to have a patient recover under these circumstances. A patient will occasionally leave the operating-room alive, if the surgeon is not too persistent in his efforts to cleanse the peritoneal cavity.

Certain untoward intra-peritoneal complications follow the operation in this as in other cases necessitating the opening of the abdominal cavity. These occur in about the same proportion as in laparotomies in general. They consist in intestinal obstruction due to intestinal paresis, ileus, or angulation. The intestinal obstruction due to intestinal ballooning is an almost necessary accompaniment of septic peritonitis; the prognosis after this condition is once fully established is very unfavorable. I do not remember ever to have seen a patient recover under these circumstances; certainly not after its occurrence in the course of septic peritonitis from appendicitis.

Ileus or angulation, or both, may be present before operation. The latter condition is of more frequent occurrence, and may be due to the manner in which the adhesions form about the ileo-cæcal valve. The gravity of the case will be necessarily increased by the occurrence of this accident.

The occurrence of angulation after the operation may be due to adhesions which form between the intestine and some adjoining serous surface that has either been abraded, or has been the site of a former adhesion, or a stump of ligated omentum. The last-named condition occurred in one of my cases.

The Treatment of Appendicitis.

While the physician is very generally first summoned to a patient suffering from appendicitis, the responsibility of the treatment should be shared both by the physician and by the surgeon. The great majority of cases should be treated surgically. Beyond the careful use of salines in the very commencement of the disease, and this only if the symptoms denote a mild type of the affection, the less medical treatment which cases of appendicitis receive the better. Above all things the use of opium must be

avoided as much as possible. Its use masks the progressive character of some of the most important symptoms; with free use of the drug the patient's condition seemingly improves, but a sudden increase of pain, followed by distention of the abdomen, accompanied or followed by a rapid pulse and some rise of temperature, announce the occurrence of septic peritonitis. It should not be forgotten that an exceptionally virulent infection may produce septic peritonitis with neither primary perforation of the appendix into the peritoneal cavity nor rupture of an abscess cavity; delay in operative interference in such cases will certainly result in disaster, and interference may fail to save the patient.

The indications for operative interference during an attack of appendicitis may be summed up in a few words: As soon as the diagnosis of progressive appendicitis is assured, the abdominal cavity should be opened and the appendix removed. If opium has been injudiciously administered, and the progressive character of the case in hand is doubtful, it is better to err upon the side of safety, and remove the appendix at once. The conditions present are usually beyond the power of nature to remedy, while, in the hands of a surgeon who pays strict attention to aseptic details of the operation, the latter entails less risk to life than that which is involved in even a mild attack of appendicitis which remains stationary at the end of twenty-four hours, with all its possibilities of lymphangitis, infection of the peritoneal cavity, retained muco-pus within the tube, and rupture of the latter into an unprotected peritoneal cavity; or ulceration and perforation either from the presence of so-called coproliths or inspissated fæcal matter imprisoned by constriction within the cavity of the appendix, or from gangrenous conditions alone.

In formulating a definite rule for action in the operative treatment of appendicitis many difficulties are met with. To operate too early may be to operate unnecessarily, but this is always preferable to operating too late and hence unsuccessfully. The fact that operative procedures are quite safely performed where a distinctly outlined and encapsulated abscess cavity is present, provided the surgeon does not disturb its wall, has led

Reclus and Schmit, of Versailles,[1] to adopt this period as the stage of election. These surgeons content themselves with simply emptying the pus-cavity. On the other hand, many surgeons advocate operation as soon as the diagnosis of appendicitis is made, whatever its grade of severity. A case demanding operation inside of twenty-four hours from the commencement of the attack is exceptional; but a case which is not practically well at the end of that time should be made the subject of operative interference. The surgeon, however, should by no means limit himself to that period. In cases in which unusually severe symptoms, such as high temperatures and a succession of rigors, are conjoined with exquisite tenderness in the right iliac fossa and an anxious facial expression, the surgeon should not hesitate to give the patient the benefit of an early and radical operation.

Where the patient is not seen by the surgeon until the third, fourth, or fifth day of the attack, the question as to whether or not the operative procedure may be contraindicated by the impossibility of removing the appendix without breaking down the adhesive barrier which has been thrown out is one which is frequently encountered by those engaged in this class of work. As very tersely stated by Richardson,[2] we may be confronted by cases which are in such a condition as to be too late for the early operation, and too early for a safe late operation. In deciding this question, much will depend upon the experience of the operator, and the facilities which he may possess in the shape of skilled assistance and other requisites to meet all emergencies as they arise. With a thoroughly trained first assistant to stand opposite to the operator, and who with thick gauze compresses, wet with a $\frac{1}{1000}$ sublimate solution, is able to keep the field of operation well isolated from the rest of the peritoneal cavity, as well as the small intestines out of the way, the operation at this the period of localized peritonitis, with or without encysted seropurulent collections, is both safe and advisable. It will be almost next to impossible to avoid breaking down some of the adhesions,

[1] Discussion upon appendicitis before the Surgical Society of Paris. Bull. et Mem. de la Société de Chirurgie de Paris, Vol. XVIII.

[2] The American Journal of the Medical Sciences, January, 1894, page 13.

but with care on the part of the operator and a perfectly trustworthy assistant, removal of the appendix may be accomplished without undue risk of infecting the general peritoneal cavity, even under these circumstances, particularly where the collection lies dextral to the ascending colon.

In some cases it may be possible to remove that portion of the appendix which is the seat of ulceration, perforation, or gangrene without being able to safely isolate and excise the remainder. Under these circumstances the portion accessible may be ligated and removed, the patient being advised to submit to a subsequent operation for the removal of that which must, in the patient's best interests, be necessarily left.

If the surgeon is called in after peritonitis has developed, operative measures may still be instituted, although the chances of recovery under these circumstances are relatively small. Infection of effused serum following peritonitis, not necessarily suppurative, offers just sufficiently encouraging results to impel the surgeon to offer the patient the benefit of a late interference. The case is almost necessarily hopeless after general suppurative peritonitis has commenced; the chances of recovery progressively diminish with the lapse of time following the beginning of the peritonitis.

If the septic peritonitis is due to the rupture into the peritoneal cavity of one or more of the minute embolic abscesses which sometimes form in the wall of the appendix in the course of a suppurative inflammation of the walls of the organ, an operative procedure may still be undertaken, provided the serous effusion is not large nor present sufficiently long to give rise to septicæmia.

If the entire contents of an abscess cavity, or of an intraperitoneal encysted serous effusion which has undergone suppurative changes, have been discharged into the cavity of the peritoneum, the surgeon will be confronted by a condition of affairs which may well cause him to hesitate. In such cases it is advised by some to flush out the peritoneal cavity with sterilized water, or with an artificial plasma, with the view of ridding the patient of the source of the general infection which almost neces-

sarily comes on under such circumstances. The operator, however, will be guided to a great extent by the condition of the patient. In my own experience I have never seen this procedure result in benefit when attempted; usually the patient's condition was such as to impel me to abstain from the effort, or to very quickly abandon it. It is usually impossible to follow the septic fluid, pus and fæcal matter in those cases in which the appendix sloughs away from the cæcum, and leaves a perforation communicating directly with the intestinal tract. The operator will be compelled, as a rule, to content himself with cleansing that portion of the peritoneal cavity which can readily be reached, and afford drainage by means of antiseptic gauze.

Certain cases may require a lumbar incision; those, for instance, which have resulted in a lumbar phlegmon. Here the indications are clear: The area of suppuration should be freely incised, and access afforded to its deepest point. The question of draining localized sero-purulent collections through the rectum or through the vagina rather than through the otherwise unaffected peritoneal cavity, is one requiring careful consideration. The difficulties experienced when either of these routes are chosen introduce dangers into the case which outweigh those following the adoption of the intra-peritoneal route. I am not prepared to say, however, that I would decline to adopt such a course as that above indicated, in an individual case, in which a fluctuating tumor could be plainly made out from the direction of one of the cavities mentioned, and in which it was sufficiently certain that the intervening structures were so matted together by the inflammatory process as to afford a reasonable guarantee against connective-tissue extravasation or infection, or both, by means of the contents of the abscess. In other words, unless the latter is clearly pointing in one or another of the directions last mentioned, drainage by one of these routes is unsatisfactory, to say the least, and not to be chosen.

In those instances in which the presence of a true appendical abscess can be made out, the purulent collection having taken place in the post-peritoneal connective tissue, and bounded anteriorly by the transversalis fascia and posteriorly by the iliac

fascia, the abscess cavity may be reached by a horizontal or an oblique incision placed to the outer side of the epigastric artery. The skin, superficial fascia, aponeurosis of the external oblique, the transversalis muscle and transversalis fascia are successively divided. By this means the focus of suppuration is reached without incising the peritoneum.

The operation chosen should be carried out with the most rigid attention to aseptic surroundings and conditions, even though infection of the peritoneal cavity is known to have already taken place, or though suppuration be present. There can be no excuse for any failure in the aseptic technique, even under such circumstances. Unless asepsis can be satisfactorily secured at

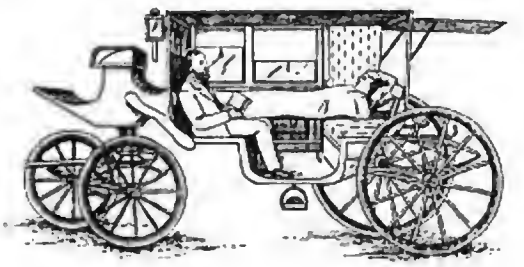

FIG. 1.—Invalid coach designed by Dr. MacNaughton. The side of the coach is represented as having been removed, in order to show the arrangement of the interior.

the patient's home, it will be better to transfer him to some hospital well equipped for the work than to attempt any makeshifts. With the invalid's coach, devised by Dr. MacNaughton, this can be accomplished in a perfectly safe and satisfactory manner. (Figs. 1 and 2.)

The Trendelenburg position (the elevated pelvis position) is best adapted for the removal of the appendix, provided no septic fluid surrounds the latter. In case an encysted sero-purulent deposit or an appendicular abscess is present, this position has the disadvantage of facilitating the passage of the pus to the upper portion of the peritoneal cavity, and at the same time of preventing the rapid turning of the patient upon his right side in

order to obtain the assistance of gravity in preventing the infection of the peritoneal cavity. For operations performed between the attacks, as well as during the first few hours of an attack, it is greatly to be preferred.

The dorsal position should be first employed in all doubtful cases which are operated upon in the uncertain intermediate stage. If it is found upon reaching the appendix that neither sero-purulent nor purulent material is present, the patient may be brought to the Trendelenburg position for the remainder of the procedure. This may be readily accomplished if a proper table is employed, which permits an easy and rapid change from one position to another. In order to facilitate the turning of the patient to either side, and at the same time to enable the operator

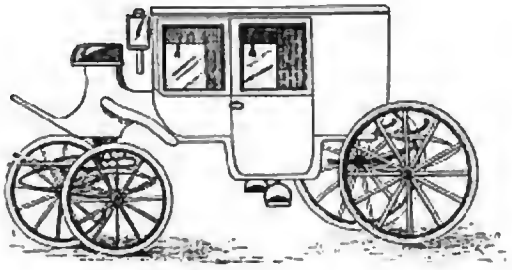

FIG. 2.—Coach closed and ready for the transportation of the patient.

to obtain the advantages of the Trendelenburg position when this can be employed, I have had a table constructed, shown in Figs. 3, 4, 5 and 6. A reference to the cuts will explain its mechanism without further description. If a tumor is felt, it is fair to assume that septic fluid is present, and the dorsal position must be used, with facilities for turning the patient over on the right side at a moment's warning.

The position and direction of the incision are to be selected in accordance with the conditions present and the purpose of the operator. If the case is one in which the surgeon will probably undertake to remove the appendix, the vertical incision, passing along the dextral edge of the right rectus muscle, may be chosen.

(Fig. 7.) If a tumor be present, and the object of the operator is simply to evacuate an abscess, an incision, following the general direction of the fibres of the external oblique muscle over the most prominent portion of the tumor, will be better. In case the diagnosis is doubtful, and the operation is, to a great extent, an exploratory one, the median incision is to be selected. Another method of gaining access to the parts, which I have latterly employed in both classes of cases, is through the oblique incision. (Fig. 8.)

The vertical incision gives the best access to the underlying parts, and permits a ready exploration, as well as ease of ex-

FIG. 3.—Operating table, with steam or hot-water coil attachment for heating. The bed of the table swings upon trunnions at either end, and is secured in position by a simple device.

cision of the appendix. A disadvantage of its employment, however, consists in the frequency with which the operator injures the efferent branches of the deep epigastric vein, which accompanies the artery within the sheath of the right rectus muscle. The artery can easily be avoided, but the veins that empty into the epigastric vein or veins, for there are sometimes two, are quite large, and pass almost at right angles to the incision. Again, in suturing the wound, if the sutures are properly placed, and include the muscular structure, the trunk of the vein may be punctured by the needle. This is sometimes the cause of vexatious delay during the completion of the operation.

The oblique incision is not open to the above objection, but its employment necessitates somewhat more retraction of the inner edge of the incision if the caput coli does not come readily into view. This disadvantage can be overcome by the aid of a competent assistant, although where there is much tension of the abdominal muscles it keeps both his hands constantly in use for this purpose. While abdominal retractors have their proper sphere, there is nothing that can compare in this operation with the fingers of an intelligent co-worker.

To facilitate the search for the collection of sero-purulent matter or pus which, when intra-peritoneal, in the majority of

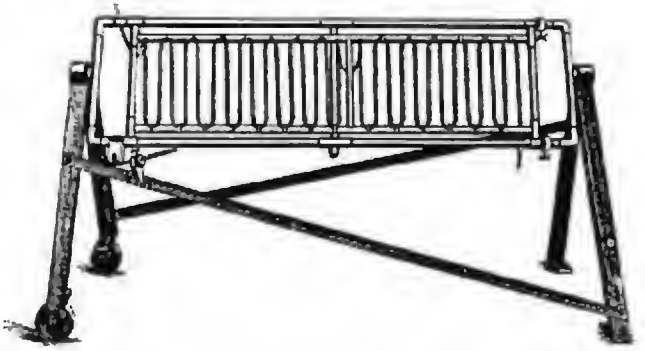

FIG. 4.—Operating table tilted to one side to facilitate emptying of an abscess cavity or an encysted intra-peritoneal sero-purulent collection.

cases is to be sought between the caput coli and the lateral pelvic wall, an additional incision may be made extending from the middle of the oblique incision downward and outward at right angles to the former. (B, Fig. 8.) To facilitate exploration in an upward and inward direction an additional incision may be made from the cephalic limit of the oblique incision, in a direction upward and inward to the dextral edge of the right rectus muscle. (C, Fig. 8.) These two additional incisions, while they will cross the fibres of the external oblique muscle, will run parallel with the fibres of the internal oblique muscle. The additional incision first described, which extends from the middle

of the oblique incision towards the anterior superior spinous process of the ilium, has the advantage of facilitating drainage in certain cases, and of permitting of suturing of the entire incision exclusive of this. Subsequent ventral hernia is avoided in those cases in which it is most apt to occur, namely, suppurating cases in which the abdominal wound cannot at once be closed. This portion of the oblique "T" incision, even if it unites only by secondary intention, is the least likely to give rise to ventral hernia of any of the incisions in the abdominal wall that are employed in appendicitis cases.

As the incision deepens over the seat of the disease, if the

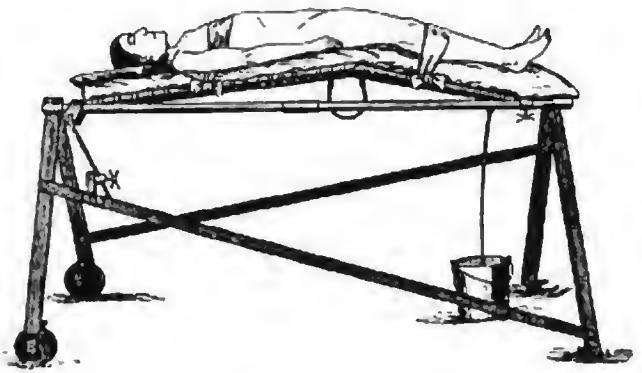

FIG. 5.—Showing patient secured to the table ready for tilting to one side. The slight elevation of the bed of the table brings the field of operation in a conveniently prominent position.

latter is ventrally placed and advanced to the stage of suppuration, some œdema of the abdominal wall, with or without matting together of its separate structures, will be observed. Where no suppuration is present, or where it is deeply placed dorsally or in the pelvis, this will not be seen. When present it will serve as a guide to any adhesions between the peri-appendicular structures and the abdominal wall, and will sometimes enable the operator to reach the interior of a sero-purulent or purulent collection without invading the peritoneal cavity at this stage of the operation.

If no adhesions exist ventrally, the operator proceeds at once to expose the cæcum by making any necessary addition to his original cut. Abdominal compresses, made of six or eight thicknesses of cheese-cloth, eight inches square, hemmed at the edges to prevent fraying, and wet with a $\frac{1}{1000}$ solution of mercuric chlorid, are now introduced as far as possible upon all sides of the exposed diseased area in order to thoroughly isolate the remainder of the peritoneal cavity from the primary focus of infection. Everything is now in readiness to turn the patient over upon his right side at a second's warning. Adhesions are now gently parted, always commencing with those between the

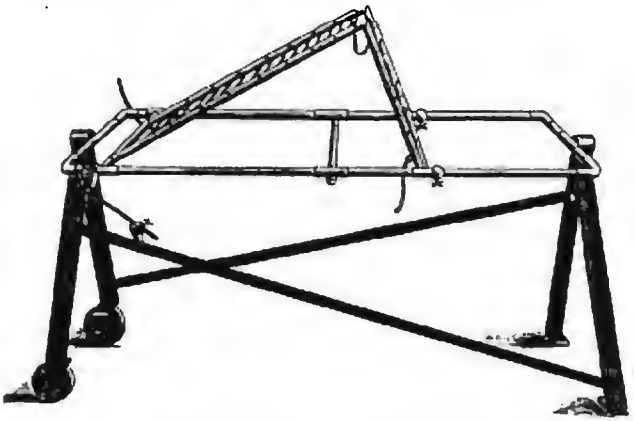

FIG. 6.—Operating table in the Trendelenburg position.

pelvic wall and the outer surface of the colon, if any exist at this point. The site of the disease is thus sought. Immediately upon the appearance of any sero-purulent material this is gently but rapidly wiped away, if small in amount; the patient is turned upon his right side, if the quantity be large, and there supported, while the fluid which flows out is gently washed away. The finger is now carefully introduced at the point between the adhesions from which the fluid made its first appearance, and further egress given to the latter. At the same time the operator ascertains whether the parts in the neighborhood are well walled

off from the peritoneal cavity. If this is assured, he may venture to wash out the cavity directly with a gentle stream from the irrigating apparatus. For purposes of irrigation either Thiersch's boro-salicylic solution or a freshly-prepared solution of sodium chlorid, or of the normal salts of the blood in sterilized water may be employed at this stage of the operation. Plain sterilized water will answer the purpose. When an abscess cavity is to be disinfected, however, a $\frac{1}{2000}$ solution of mercuric chlorid is to be used. This in its turn is to be washed away with one of the solutions just named. During the time that the patient is turned upon his side it is of the greatest im-

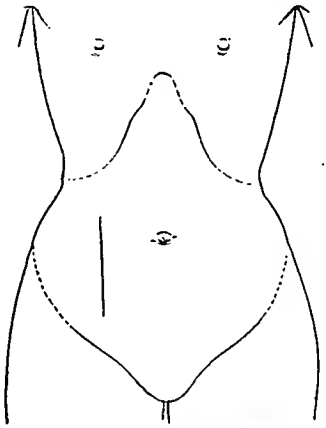

FIG. 7.—The vertical incision.

portance that the first assistant attend strictly to the task of retracting with his hands the edges of the abdominal wound and of keeping the remainder of the peritoneal cavity isolated, as well as adjacent coils of intestine, when adhesions have been broken down, from falling into the septic area, by means of large and thick gauze compresses.

After the purulent material has ceased to flow, and the parts have been cleansed as well as the position will allow, the patient is replaced in the dorsal position, and the search for the

appendix is continued. The Trendelenburg position may now be employed to facilitate this stage of the operation, as well as to relieve the principal assistant. Watchfulness must be exercised for other sero-purulent deposits, and everything made ready for the right lateral position, should necessity demand it. Personally, I never feel perfectly comfortable with the patient in the Trendelenburg position, except in those cases in which I am operating very early in the disease, before any intra-peritoneal foci of suppuration are present, or very late, when an appendicular

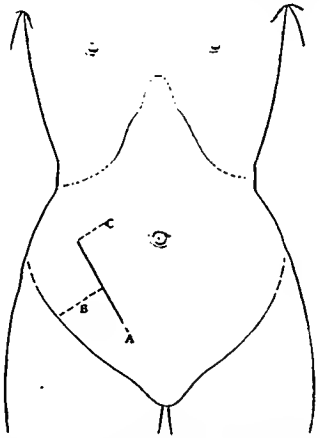

FIG. 8.—A, the oblique incision. The longer dotted line, B, employed for the purpose of facilitating drainage in cases in which it is deemed advisable to close the oblique incision, converts this into the oblique T incision. The shorter dotted line, C, is sometimes useful when further exploration is found necessary.

abscess exists. These latter are usually single, are walled off by strong adhesions, and present and empty themselves promptly upon opening the peritoneal cavity, after which the elevated pelvis (Trendelenburg's position) offers many advantages.

If the vermiform appendix does not come readily into view, or within reach of the operator, search for its site may be further facilitated by identifying the location of the cæcum. This is done by means of the pouched appearance of the latter organ,

as well as by the presence of the three flat, longitudinal, muscular bands, each about half an inch in width, which commence at the attachment of the appendix to the cæcum. The ventral band, the largest of the three, will usually come into view, unless shut off by adhesions; the dorsal band is placed along the attached border of the intestine. The identification of either of these bands will serve as a guide to the appendix. The third or lateral band is placed upon the sinistral side of the ascending colon, and if adhesions are present, will not be available in the search.

As the adhesions are parted the appendix is identified. This will be found to be of a somewhat solid consistency, feeling not unlike a slightly flexed little finger. It is to be carefully freed from its surroundings by the finger of the operator, very much in the manner in which the Fallopian tube is isolated in the operation for pyosalpinx.

In the attempt to isolate the appendix the surgeon must not lose sight of the fact that he may do more harm than good if the organ is so placed as to form a portion of the protecting wall of adhesions; particularly if its position prove to be on the lines N. E., E. or S. E. On the other hand its isolation and removal from the positions S., S. W., W., N. W. and N. will generally be found practicable and safe. If symptoms of intestinal obstruction have been present in the case, it will be best, even with the additional risk, to break up all adhesions with the view of relieving the obstruction, first being assured that thorough disinfection of the primary focus of sepsis has been accomplished.

The manner of dealing with the appendix will vary with the character of the case. In some instances its condition will not admit of any choice. Simple ligature, by means of chromicized catgut at its base, or as near thereto as possible, the mesentery being included in a separate ligature, whenever practicable, and amputation of the organ, the mucous membrane being destroyed by means of the thermo-cautery or fuming nitric acid, is deemed quite sufficient by some surgeons. Indeed, it happens only too frequently that the exigencies of the case will only permit of this method, as in cases in which abscess or a sero-purulent fluid is present, and it is found impossible to gain room for the applica-

tion of a typical procedure without running the risk of breaking down limiting adhesions. The wall of the appendix, if in a gangrenous condition, will sometimes scarcely hold a ligature, much less permit of the application of a series of sutures in closing over the stump in some of the methods proposed. The application of a pair of clamp forceps or hæmostats to the site of the base of the appendix must suffice in some instances. Even the adjoining wall of the cæcum itself is frequently softened by inflammatory processes, and will not hold a suture. Again, the patient's condition will not admit of the delay necessary in these niceties of technique in many of the cases which fall into the surgeon's hands.

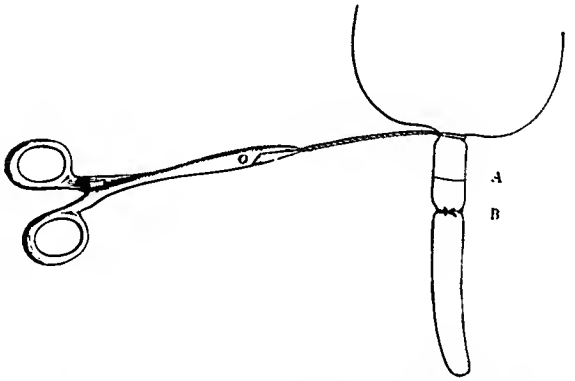

FIG. 9.—Temporary constricting ligature in position. A, Line of circular incision; B, second ligature applied to the appendix to prevent escape of its contents when the final amputation is accomplished.

Where a rapid completion of the operation is not demanded, and the condition of the parts will permit of it, the method which I have employed with very great satisfaction is that of the circular flap amputation. The employment of this procedure is almost entirely limited to cases of the recurrent and chronic relapsing varieties of the disease operated upon in intervals between the attacks. It is carried out as follows:

A temporary ligature is thrown around the base of the appendix close to the cæcum. (Fig. 9.) This is not tied, but

simply twisted until it constricts the organ sufficiently to prevent the escape of fæcal matter from the cæcum should the cavity of the appendix be accidentally invaded before the application of the final and permanent ligature. This temporary ligature should be sufficiently long to be grasped by a pair of clamp-forceps at its extremity, which will aid in the twisting; at the same time it will, by its weight when dropped outside the wound in the abdominal wall, prevent the untwisting of the ligature. A second ligature is applied and tied about the appendix at a point half an inch distal of the first ligature. (B, Fig. 9.)

A circular incision is now made, either by means of a sharp scalpel, or preferably by snipping with the points of the scissors, in the space between the two ligatures. (A, Fig. 9.) This

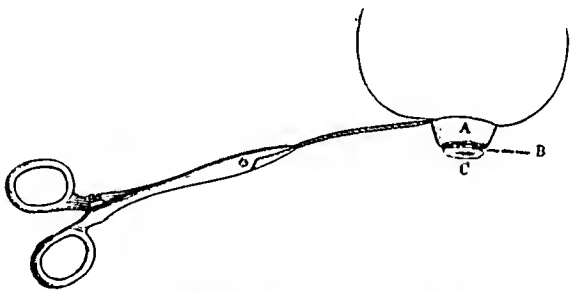

FIG. 10.—A, Cuff-shaped flap of serosa and subserous connective tissue; B, permanent ligature of the muscular wall and mucous lining of the appendix; C, mucous membrane remaining in stump.

should include the serosa and the subserous connective tissue. A cuff-shaped flap, (A, Fig. 10) formed of these structures, is turned back toward the temporary ligature until the latter is reached, precisely as the cuff-shaped flap in a circular amputation of the arm is turned back to uncover the underlying structures. A ligature of fine, ordinary catgut is now placed around the wall of the appendix at the bottom of and within the reflected cuff of serosa, and as nearly upon the same level as the temporary constricting ligature as possible. (B, Fig. 10.) The catgut ligature, here employed, should not be chromicized, but prepared without any hardening process; boiling in alcohol accom-

plishes the purposes of sterilization without materially altering the other qualities of the gut. This ligature is tied tightly and cut off close to the knot. Its purpose is to prevent hæmorrhage from the cut surface of the wall of the appendix, as the latter is cut away, and to shut off the cavity of the cæcum when the temporary constricting ligature is removed. The appendix is now amputated and the mucous membrane remaining in the stump (C, Fig. 10) touched with the thermo-cautery or

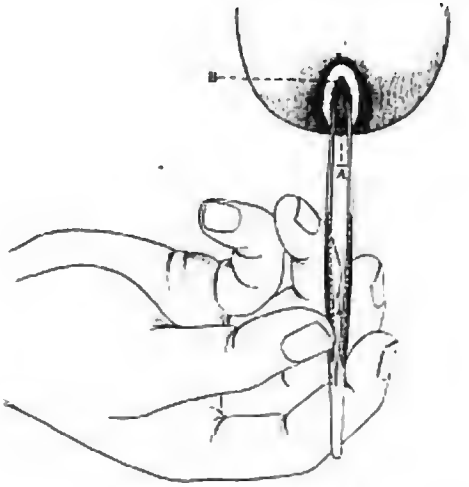

FIG. 11.—A, Stump of appendix, grasped with a pair of forceps and crowded into the wall of the cæcum; B, furrow in which the stump is burned.

fuming nitric acid. The best method of applying the nitric acid is by means of an inverted Hagedorn needle grasped in the jaws of a hæmostic forceps. The large eye of the needle holds just sufficient of the acid for the purpose, and by carrying the proper amount, and no more, to the point needed insures against bringing the parts adjacent to the stump in contact with the acid. The cuff-shaped flap is now placed over the face of the stump and the latter is grasped by means of a pair of dissecting forceps, and crowded against the wall of the cæcum

in such a manner as to form a furrow or depression in the latter (Fig. 11); the edges of the latter are sutured together over the stump of the appendix by means of a double row of Lembert sutures, so as to bury the latter out of sight (Fig. 12).

In the course of two or three days the ligature about the wall of the appendix, and which has been buried into the furrow with the stump of the latter, gives way. In the meanwhile the sutured edges of the furrow have become strongly adherent, and there is no longer danger of escape of the contents of the cæcum. This loosening of the ligature permits a smoothing out of the little dimple which took place upon the mucous membrane side of the cæcum at the site of the former communication of the latter with the appendix, upon the application of the ligature. Finally, cicatrization at this point, conjoined with the thickening of the cæcal wall resulting from the suturing together of the

FIG. 12.—Furrow in the wall of the cæcum sutured over the stump of the appendix.

edges of the furrow upon the peritoneal surface, leads to a firm and solid condition of the intestinal tube at this point.

In cases in which the wall of the appendix is in a sufficiently good condition to bear the application of a ligature, and yet the surrounding structures, or the exigencies of the case from some other standpoint, will not permit of the manipulation necessary to carry out the above procedure, a ligature may be thrown about the organ at its base, including its serous surface, the organ amputated distad of this, the pouting portion of mucous membrane in the stump destroyed by the thermo-cautery or nitric acid, and the stump itself sunk into the furrow upon the peritoneal surface of the cæcal wall, as just described. In the majority of cases operated upon during the active existence of the disease, this method of dealing with the appendix will constitute as near

an approach to the typical procedure as it will be possible to accomplish. Its employment will therefore be more frequent than that of any other.

The meso-appendix should, as a rule, be dealt with separately. It will sometimes be found practicable to bring the stump of the mesentery over against the site of the stump of the appendix so that its raw surface is applied to the raw surface of the latter, thus doing away with the necessity of burying this in a furrow of the cæcal wall.

This latter is a useful procedure, particularly in those cases in which a typical method like that above described cannot be carried out. In any event it insures a firm covering and more solid protection to the weakened wall of the cæcum at the point from which the appendix has been removed, and, what is also of very great importance, by this method of technique the leaving of raw surfaces of peritoneum is avoided, and the formation of vicious adhesions leading to angulation of intestine, and subsequent obstruction prevented.

If the base of the appendix is unusually broad, as in the fœtal type, the appendix, together with a portion of the wall of the cæcum, if practicable, should be excised, the edges of the opening being afterwards approximated, and a double row of Lembert sutures applied. Where the cæcum is sufficiently free from adhesions to permit of its being brought outside of the peritoneal cavity, thus avoiding the risk of infecting the peritoneum by means of its contents, the latter procedure may be found an exceedingly useful one, even in cases of simple appendicectomy, the ordinary type of the organ being present.

If it is decided not to remove the appendix, its surroundings may be carefully disinfected with a 10-per-cent. solution of chloride of zinc, and the abscess cavity lightly tamponed with Mikulicz's wick-drains, or drains made of iodoform or zinc oxide gauze.

The strips of gauze used for tamponing should have their edges folded in as follows: a strip of the material is taken and smoothed out; each edge of this is now turned in in such a manner that both edges will meet in the middle; the strip is again folded, bringing the two doubled margins together; a running

thread holds these folds in position; these strips are placed in position in an antero-posterior direction as regards the patient's body (anatomically speaking), and the strips systematically arranged in successive layers or folds, so as to effectually shut off the remainder of the peritoneal cavity, as well as to facilitate the removal of the gauze. My plan is to take a portion of the gauze strip and lay it in folds, the one upon the other, so as to make a drain sufficiently long for the purpose. This is placed in position in such a manner that when removed layer by layer, those layers which are farthest removed from the peritoneal cavity, and hence the nearest to the abscess cavity, are removed first. A number of these are sometimes required. The outer ends of the strips of gauze should be brought out of the most dependent portion of the external wound. The primary incision should be closed as much as possible, consistent with free drainage and the easy removal of the gauze tampons. The advantage of the T-incision under these circumstances will be very great.

If the appendix is so situated as to admit of removal, the question must be decided whether it is best to close the wound entirely, or whether it shall be partially closed and the cavity tamponed. In coming to a decision, the extent of the infection, the completeness with which the cavity can be disinfected, and the size of the cavity are the chief considerations to be taken into account. Provisional sutures, designed to serve as secondary sutures, are placed in position, and left loose ready for tying when the proper time arrives. These provisional sutures are to be placed throughout the entire extent of the wound not closed at once.

The method of suturing and the material employed are of some importance. The "crossed suture," an account of which I have already published,[1] is designed to secure coaptation of the separate structures represented in the edges of the incision. Corresponding parts are included in the individual loops of the same suture, thus doing away with the necessity of leaving buried sutures *in situ* (Fig. 13). The material used may be

[1] ANNALS OF SURGERY, Vol. XV, No. 5, May, 1892, p. 351.

silkworm-gut, horse-hair, or Chinese silk; the first named being preferable.

The outer dressings employed are such as are used after abdominal operations in general. The indications for redressing the depths of the wound cavity in cases which are simply tamponed are as follows:

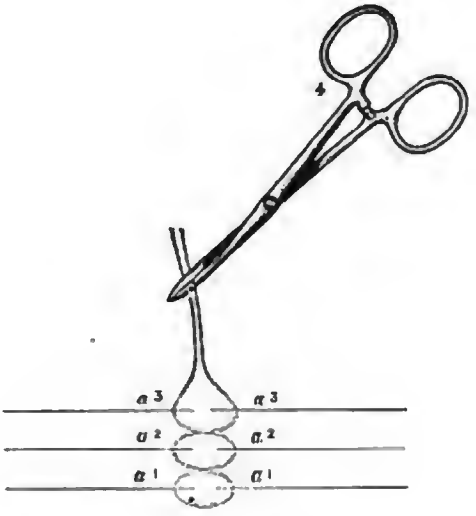

FIG. 13.—The crossed suture.

a^1, Line representing the peritoneum.

a^2, Line representing the muscular and fascial layers.

a^3, Line representing the integumentary layer.

4, Hæmostatic forceps temporarily securing suture for ready dentification until all are ready for tying.

All three layers are shown included in the loops of the crossed suture, ready for tying.

In those cases in which adhesions are broken down, and the general cavity of the peritoneum opened, the gauze packing which isolates the stump of the appendix and the site of the formerly existing purulent collection from the peritoneal cavity should be left undisturbed for several days, until protective adhesions have formed beyond the gauze.

Where the abdominal wound is entirely closed at the time

of the operation the dressings need not be removed until ten days or a fortnight have elapsed, at the end of which time the sutures may be removed. Exceptions may be found to this rule, in instances in which stitch-abscesses occur.

Where the wound is partially closed and provisional sutures are placed in position the latter may be drawn taut, so as to close the wound as soon as the septic conditions have passed away and healthy granulations make their appearance. A small opening may be left at the lower angle of the incision for drainage if a cavity is found to exist beneath the surface following the tightening and tying of the provisional sutures. If no provisional sutures have been placed in position, secondary suturing of the wound should be done as soon as it is in proper condition for the same. The drawing together of the unclosed portion of the wound by means of previously-applied provisional sutures, or the application of secondary sutures, at as early a day as possible, will tend to insure the patient against the occurrence of ventral hernia as a sequel to the operative procedures.

In order to facilitate the removal of the gauze strips in cases in which it is found necessary to employ these, and to disturb the parts as little as possible while this is being done, it is best to remove the strips in the reverse order from that in which they were placed in position. In order to accomplish this with certainty the strips are numbered with India ink when they are made, and then used in regular order, or else they may be knotted as they are used, the number of knots serving to identify them.

If the exigencies of the case and the character of the attack have permitted it, the patient's bowels will have been thoroughly moved before the operation as a part of the routine of the preparatory treatment. Saline cathartics are best for this purpose. With or without this preliminary treatment the surgeon will always feel easier when his efforts to secure a number of fluid movements by the use of saline cathartics have been successful. In those cases in which typical suture or ligature of the appendix has been impracticable, or in which the removal of the organ is not deemed safe, fæcal extravasation, either from an insufficiently-

secured stump or from a perforated appendix, is to be feared, and measures taken to prevent a fluid condition of the intestinal contents for several days. The lower bowel may be cleared out by means of simple enemata, however, with advantage, even in these cases. Where early movements are permissible or indicated the longer this is postponed the greater are the chances of the occurrence of those dreaded conditions, septic peritonitis and intestinal paresis. In these latter cases, therefore, as soon as the stomach of the patient will bear it, a half-ounce dose of sulphate of magnesium dissolved in Vichy water should be given. This is to be followed by drachm doses, given hourly, until the bowels act thoroughly. By this means the peritoneal cavity is effectually drained; the serous effusion finds its way into the intestinal canal by means of endosmosis, as the latter is emptied of its contents.

Of late it has been my habit to wash out the patient's stomach while he is still under the anæsthetic, immediately placing therein an ounce or more of a saturated solution of sulphate of magnesium when the use of this is indicated. The advantages of this procedure consist, first, in getting rid of a considerable amount of mucus, more or less loaded with ether or chloroform, which has found its way into the patient's stomach during the administration of the anæsthetic, whereby the after-vomiting is very much lessened, and, second, in insuring the retention of at least this first dose of the saline, when this is administered in addition.

The after-treatment, exclusive of the precautions alluded to, is that of laparotomies in general; early (when indicated) and free purgation, by means of salines when these are well borne by the stomach; the use of small doses of calomel, followed by a pill of extract of colocynth, extract of jalap, and podophyllin, when the stomach will not bear the salts; drachm doses of hot water, half hourly, during the first twenty-four hours, this to be followed after that time by half-ounce allowances of peptonized milk, gradually increased to full milk diet in the course of the following two or three days; then farinaceous food and meat, gradually leading up to full diet. If the patient's condition

require them, nutrient or stimulating enemata may be administered. Pain is to be controlled by hypodermatic injections of morphia.

Most of the post-operative complications are such as are met with in other abdominal operations. Excessive vomiting may be relieved by lavage, using a solution of boracic acid (3iij to Oj). While the stomach tube is still in position, a dose of Epsom salts may be given if the use of this is still indicated and it has not been previously retained in the stomach. The administration of a quarter of a grain of cocaine dissolved in water and given five minutes before the salts are to be given will frequently enable the latter to be retained.

The occurrence of peritonitis demands prompt action. It is impossible to lay down any hard and fast rule in the treatment of this complication. Free drainage through the intestinal canal offers the best chance to the patient; how difficult this is to accomplish those know only too well who have had much to do with this condition. The ice coil, although its curative properties may have been greatly overestimated, should be employed on account of its tendency to relieve pain, if for no other reason. As a rule, its use greatly increases the comfort of the patient.

With the development of intestinal paresis increased difficulty in effecting movements of the bowels is experienced. Small doses of calomel in conjunction with, or alternating with, the sulphate of magnesia are sometimes useful. In connection with this, strychnia is given, hypodermatically, in 1-20 grain doses, hourly, or even half-hourly, in extreme cases. Faradization, one pole being placed in the rectum, and the other spread over the abdominal surface or stroked along the course of the large intestine, has been of use in my hands. Half-hourly séances of ten minutes each are sufficiently frequent. The condition, however, is a symptom of a general septic peritonitis, which will, in all probability, prove fatal, if the intestinal paralysis becomes complete. A general abdominal and pelvic septic peritonitis is, in my experience, an invariably mortal affection. Without exception, complete intestinal paralysis, occurring in connection with peritonitis, is the forerunner of a fatal issue.

The occurrence of septic peritonitis is usually postponed for from twenty-four to forty-eight hours, following the operation, more frequently the latter. If septic peritonitis is already present at the time of the operation, this interval, of course, will not be observed. The supervention of septic symptoms is exceedingly insidious. A gradual increase in the pulse rate, and slow, but persistent rise of temperature, particularly if these are conjoined with an obstinately constipated condition of the bowels, should always arouse suspicion. If vomiting sets in, both nourishment and medicines being rejected, and this be sufficiently removed, say by six or eight hours, from the vomiting resulting from the anæsthetic, and, in spite of all efforts to move the bowels no indications of passage of flatus, from one portion of the tube to another, are obtained upon auscultation of the abdomen, the case is a hopeless one. From this time on the course of the case will be typical, as a rule. The stomach rejects everything placed in it. The accumulation of gas and some of the fluids swallowed by the patient leads to progressive and excessive distention of the abdomen. Cold, creeping sensations and profuse perspiration set in. The surface of the body is bathed in a cold, clammy sweat. Attempts to sustain the patient, by means of stimulating and nourishing enemata, prove futile for the reason that these are promptly rejected. Jactitation now comes on; the peculiar muscular pains of sepsis cause the patient to become very restless, and this, conjoined with delirium, may necessitate extra watchfulness to restrain him from springing from the bed. The vomited matter becomes dark brown. The anxious expression of the face gives place to one of apathy or absolute hopelessness. The temperature may rise to from 105° to 107° F., the pulse becomes too rapid to count, or it may be absent at the wrist altogether. The finger-nails become blue, the skin is a dark, muddy hue; moisture exudes apparently from every outlet upon the surface.

Prior to the manifestation of the trouble every endeavor must be made to obtain a response to the salines or other cathartics administered. If within the first twenty-four or forty-eight hours these endeavors have been successful, the surgeon's mind will be comparatively easy; if unsuccessful, as already stated, the greatest anxiety must prevail.

In the treatment of this dreaded condition the ounce of prevention will outweigh many tons of cure. While the surgeon cannot be certain that anything is seriously wrong during the first twenty-four hours, the mere fact that the bowels do not move promptly will impel him to redouble his efforts in this direction until either these are successful or until it is evident that they are not likely to prove successful. If at the close of the second, or of the third twenty-four hours at the utmost, the patient's condition has shown no signs of a change for the better, all treatment should be abandoned, save that which is directed to euthanasia. In the meantime, and until it is evident that all efforts are useless, quinine in large doses, alcoholic stimulants, and strychnia should be given, either per rectum, if the latter will retain enemata, or hypodermatically.

I have never succeeded in ameliorating a patient's condition in the slightest by reopening the abdomen, under these circumstances, with the view of irrigation and drainage. It will usually happen that when the diagnosis is sufficiently assured to warrant this the case has advanced so far as to render the procedure useless, and perhaps harmful by tearing apart adhesions and exposing new surfaces to absorption. I have even gone so far as to institute and maintain continuous irrigation of the abdominal cavity, but with no effect other than to increase the distress of the patient.

If symptoms of mechanical intestinal obstruction develop, these should be met by a prompt reopening of the abdomen, and a search for, and a relief of, the imprisoned portion of the intestine. The obstruction is most frequently due to angulation, though ileus sometimes occurs.

The occurrence of vicious adhesions may lead to intestinal obstruction, at a period of time comparatively remote from the operation, and even after convalescence has been thoroughly established. The following case illustrates this condition:

M. C., aged fifteen, was operated upon for acute appendicitis in my service at St. Mary's Hospital. The appendix was removed, and the abdominal wound was closed, with the exception of about

an inch at the lower angle, where a small gauze drain emerged. The latter was dispensed with at the fourth dressing, and this portion of the wound rapidly healed by granulation. The portion of the wound that had been sutured united per primam. The patient was perfectly well, as far as the appendicitis was concerned, at the end of three weeks. Her mother gave her a banana to eat on the afternoon of the twenty-first day. After eating this she was seized with what appeared to be an attack of acute indigestion. During the night the abdomen became tympanitic, and vomiting occurred. This circumstance, together with the intractable character of the latter, and the failure to obtain a movement of the bowels, or even the passage of flatus by means of high enemata, demanded a second laparotomy. It was then discovered that a portion of the ileum had become attached by adhesions near the former site of the appendix. The adhesions were so placed as to bind down a loop of small intestine for a considerable distance toward the median line from the ileo-cæcal valve. The ballooning of the intestine by the accumulation of gas, resulting from the attack of indigestion, had produced a twist of a loop of intestine upon itself at its mesenteric attachment, thus causing both obstruction and rapid strangulation of the tissues of the intestine itself.

Fæcal communication between the cæcum and the wound-cavity may occur during the after-treatment. In one case in my hospital service, a communication between the wound-cavity and a coil of small intestine also occurred, but in this case tubercular ulceration was supposed to have been the cause. Fæcal communication usually has its origin in some condition of the vermiform appendix, which prevents the proper application of the ligature at its base. The occurrence of this accident in a case in which the abdominal cavity had been entirely closed would lead to fæcal extravasation and the most disastrous consequences. Its occurrence is usually limited, however, to the very class of cases in which entire closure of the abdominal wound is contra-indicated, namely, a septic condition of the appendix and the surrounding parts.

I have never known a fæcal communication of this kind to lead to a permanent fæcal fistula. With due attention to the cleanliness of the wound and encouraging healthy granulations,

together with care in securing frequent movements of the bowels by enemata (two or three times daily), all of the cases in my hands save one, in which this accident has happened, have terminated in complete closure of the fæcal communications before the final closure of the remainder of the wound itself. In the case mentioned, that of an elderly female, a plastic secondary operation became necessary. At the most, in the majority of cases, it will only delay for a time the application of the secondary sutures.

Mucous Sinus.—The occurrence of a mucous sinus has been met with occasionally. This results from a failure, either to completely cover the mucous membrane left in the stump of the ligated appendix, or to destroy it altogether. In my earlier operations I relied upon the application of pure carbolic acid to the stump, and in some of these a mucous sinus persisted; in one case this closed and opened several times. Permanent closure was finally effected after thorough curetting and the injection of equal parts of carbolic acid and tincture of iodine. Simple curetting, although thoroughly done on several previous occasions, had failed.

Ventral Hernia.—This has been observed in a certain proportion of cases to follow operations for appendicitis. The necessity for leaving open a portion of the abdominal wound probably gives rise to this most frequently. I have endeavored to prevent the occurrence of this complication by keeping the patient in the dorsal position for about six weeks in order to secure as much stability in the scar tissue as possible. In many cases in which the abdominal wound is closed at once, probably less than half of that time will suffice. Some form of abdominal support should subsequently be worn, particularly by those who are compelled to maintain the upright position during the entire day.

In cases where the abdominal wound is not closed immediately it will be subject to the same interruptions of the healing process as other wounds exposed to infectious influences. In the following case the healing process seems to have been complicated by the presence of a micro-organism to which, as found in man,

destructive pathogenetic properties have not heretofore been ascribed:

A. M., aged thirty-five, male, was admitted to my service at St. Mary's Hospital, with the history of having been attacked in the early hours of the morning of the previous day by all of the symptoms of appendicitis of an unusually severe character. A right lateral laparotomy revealed an appendix whose distal two-thirds was completely gangrenous. It was buried in a mass of adhesions which had also taken part in the gangrenous process. The appendix was ligated at the base, and excised. Unfortunately the circumstances surrounding the operation were such as to prevent a proper bacteriological examination. On the second day an elevation of temperature necessitated a re-dressing of the wound. It was found that the gangrenous process had extended from the cavity to the edge of the wound, and thence into the abdominal parietes towards the umbilicus, involving a space as large as the palm of the hand. The area of gangrene was marked by an irregular outline, numerous blebs, and considerable infiltration of the tissues. Stab inoculations in a sterilized agar-gelatine tube were made, and pure cultures of the *Bacillus pyocyaneus* of Gessards were obtained.

The technique of relapsing, as well as recurring cases, will not vary greatly from the foregoing. The Trendelenburg position can usually be employed, and the abdominal wound completely closed. The after-treatment will not materially differ from that pursued in any abdominal section in which complete closure of the wound is secured.

[TO BE CONTINUED.]